NASA’s Curiosity rover landed on the red planet in spectacular fashion Sunday evening. INL employees fueled and tested the radioisotope power system that will power the Mars Science Laboratory during the rover's journey.

NASA Rover Now Exploring Mars Using INL Power System

INL Communications & Governmental Affairs

There were a few tense moments around the world late Sunday night as NASA’s highly-anticipated Mars Science Laboratory hurled itself toward the red planet at more than 13,000 miles per hour. Fourteen minutes after entering Mars’ atmosphere, those anxious moments turned to joy — tonal signals and a small thumbnail photo beamed back to Earth from the Mars rover Curiosity signaled a successful landing.

Curiosity's mission has the potential to be the most productive Mars surface mission in history.

As the rover begins exploring the Gale Crater area of Mars, it will employ the most advanced payload of scientific gear ever used on Mars' surface. During the 23-month mission, Curiosity’s instruments will investigate the Gale Crater area for clues about whether environmental conditions there have favored the development of microbial life. Curiosity also will preserve any evidence it finds.

The rover's instruments will get their lifeblood from a radioisotope power system assembled and tested at Idaho National Laboratory. The Multi-Mission Radioisotope Thermoelectric Generator is the latest "space battery" that can reliably power a deep space mission for many years.

Employees at INL’s Space and Security Power Systems Facility use a special cart to move the space battery from the hot cell to a shaker table for acceptance testing.

The power system provides a continuous source of heat and about 110 watts of electricity for the rover's instruments. The nuclear fuel is protected by multiple layers of safety features that have each undergone rigorous testing under varied accident scenarios. NASA has used nuclear generators to safely and reliably power 26 missions over the past 50 years.

New generators like the one destined for Mars are painstakingly assembled and extensively tested at INL before heading to space.

"This power system will enable Curiosity to complete its ambitious expedition in Mars' extreme temperatures and seasons," said Stephen Johnson, director of INL's Space Nuclear Systems and Technology Division. "We’ve verified every aspect of its performance and made sure it was in good shape when it got to Kennedy Space Center."

The INL team began assembling the mission's power source in summer 2008. By December of that year, the power system was fully fueled, assembled and ready for testing. INL performs a series of tests to verify that such systems will perform as designed during their missions. These tests include:

- Vibrational testing to simulate rocket launch conditions.
- Magnetic testing to ensure the system's electrical field won't affect the rover's sensitive scientific equipment.
- Mass properties tests to determine the center of gravity, which impacts thruster calculations for moving the rover.
- Thermal vacuum testing to verify operation on a planet’s surface or in the cold vacuum of space.

Workers peer through the window of a specially designed hot cell as they

INL completed its tests in May 2009, but by then the planned September 2009 launch had been delayed until November 2011 because of hurdles with other parts of the mission. So INL stored the power system until last summer, when it was shipped to Kennedy Space Center and mated up with the rover to ensure everything fit and worked as designed.

The system is now supplying warmth and electricity to Curiosity and its scientific instruments using heat from nuclear decay. The generator is fueled with a ceramic form of plutonium dioxide encased in multiple layers of protective materials including iridium capsules and high-strength graphite blocks. As the plutonium naturally decays, it gives off heat, which is circulated through the rover by heat transfer fluid plumbed throughout the system. Electric voltage is produced by using thermocouples, which exploit the temperature difference between the heat source and the cold exterior. More details about the system are in this fact sheet.

complete the process of building the rover's space battery.

(*Posted Aug. 6, 2012*)

Previous coverage

Virtual tour of power system testing facility.
INL employees attend Mars Science Lab launch in Florida.
Mars Science Laboratory team accomplishes mission goal by working together.

Feature Archive